Technical Reference

Cryojet

Service Manual

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OXFORD INSTRUMENTS

Contents

Warnings

Before you attempt to install, operate or service this equipment, please make sure that you are aware of the precautions that you must take to ensure your own safety. The booklet "*Safety Matters*", supplied with the Operator's manual gives advice.

1 Introduction

Refer to the Operator's Handbook for a description of the system and troubleshooting advice. See also the controller Technical Handbook. If you concerned that the system is not set up correctly, refer to the section entitled "Configuration and Calibration" in the Technical Handbook.

2 Service kit

Part	O.I. Part number	Quantity	Uses
Cryojet spares and accessories kit	CRYOJET98SKIT	1	All required o-rings
Platinum resistance thermometer PT100	PRZ0015	1	Nozzle; shield leg heat exchanger
1/8" Watlow cartridge heater, 40 V x 40 W	PFA0021	1	Coldhead heat exchanger and shield leg heat exchanger
1/4" Watlow cartridge heater (40 V x 40 W) with two perforated copper baffles soldered to it	PFA0009 + 2 off PSN0033	1	Shield leg boiloff heater and sample flow leg boiloff heater
Copper crimps	RCT0002 (Cu tube B 0.093" x 0.022") x 5 mm long, sliced with a scalpel	10	Joining wires to the boiloff heaters
PTFE coated wire, 0.4 mm	RCW0012	10 m	Boiloff heaters
PTFE coated wire, 0.25 mm	RCW0043	10 m	Low liquid nitrogen level sensor, coldhead heater
PTFE coated stainless steel wire	EWM9705	10 m	Nozzle sensor
High temperature sleeving	EWZ0820	20 cm	To cover leads of boiloff heaters
Low liquid nitrogen level sensor	EQT0590	1	
The liquid nitrogen level sensor adjustment cable	This item has no part number	1	Check sensor voltage using a digital volt meter
Autostick ceramic adhesive	TGZ0005	1 small plastic pot	To pot in heaters and sensors
PTFE sleeve	EWZ1586	20 cm	Sleeving platinum sensor leads
Heat shrink sleeving	EWT0020	20 cm	Sleeving platinum sensor leads
Heat shrink sleeving, 1.6 mm	EWT0011	20 cm	Low level sensor connections and all the connectors

3 Wiring Information, Connectors and Cables

3.1 Standard Wiring Sheet Used for Original Wiring

(See the customer's manual for the actual wiring measurements on his/her system. The sample flow unit and shield unit each have a serial number, engraved on them a few centimetres above the dewar top fitting. These numbers are not the same as the project number.)

Shield Unit: 10-pin Fischer connector

Sensor type: PT100 platinum resistance sensor

From pin	Wire size	Goes to
1	0.25 mm	Sensor, common with pin 3
2	0.25 mm	Sensor, common with pin 4
3	0.25 mm	Sensor
4	0.25 mm	Sensor
5	0.4 mm Cu	Heat exchanger heater
6	0.4 mm Cu	Heat exchanger heater
Check all wires to ground > 1 M Ω		

From pin	To pin	Reading
1	2	Ω
1	3	Ω
1	4	Ω
2	4	Ω
5	6	Ω
7	8	Ω

Sample Flow Unit:

Dewar Leg: 4 pin Fischer connector

From pin	Wire size	Goes to
1	0.4 mm Cu	Boiloff heater
2	0.4 mm Cu	Boiloff heater
3	0.25 mm Cu	Low level sensor (-)
4	0.25 mm Cu	Low level sensor (+)
Check all wires to ground > 1 M Ω		

From pin	To pin	Reading
1	2	Ω
3	4	V

Coldhead: 4 pin Fischer connector

Sensor type: PT100 platinum resistance sensor

From pin	Wire size	Goes to
1	7/0.05 mm SS	Sensor, common with pin 3
2	7/0.05 mm SS	Sensor, common with pin 4
3	7/0.05 mm SS	Sensor
4	7/0.05 mm SS	Sensor
Check all wires to ground > 1 M Ω		

From pin	To pin	Reading
1	2	Ω
1	3	Ω
1	4	Ω
2	4	Ω

Coldhead: 10 pin Fischer connector

From pin	Wire size	Goes to
1	0.25 mm Cu	Heater
2	0.25 mm Cu	Heater
Check all wires to ground > 1 M Ω		

From pin	To pin	Reading
1	2	Ω

Wire Type	Part Number
0.25 mm Copper PTFE Covered	RCW0043
0.4 mm Copper PTFE Covered	RCW0012
7/0.05 mm SS (i.e. 7 strands of diameter 0.05 mm stainless steel) PTFE Covered	EWM9705

3.2 4 and 10 way Fischer connector pin labels

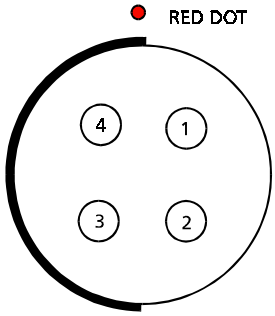


Figure 1 Pin numbers on a 4 way hermetically sealed Fischer connector viewed onto pins from the outside of the cryostat. Fischer part number 103 Z053 (DBEE). (Mating connector Fischer part number SE103 Z053)

Tip The connector on the cryostat is a plug and the pins are accessible.

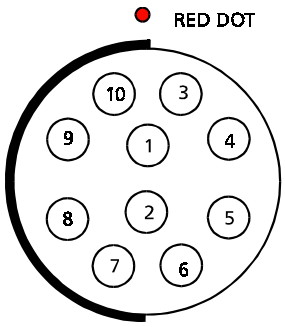
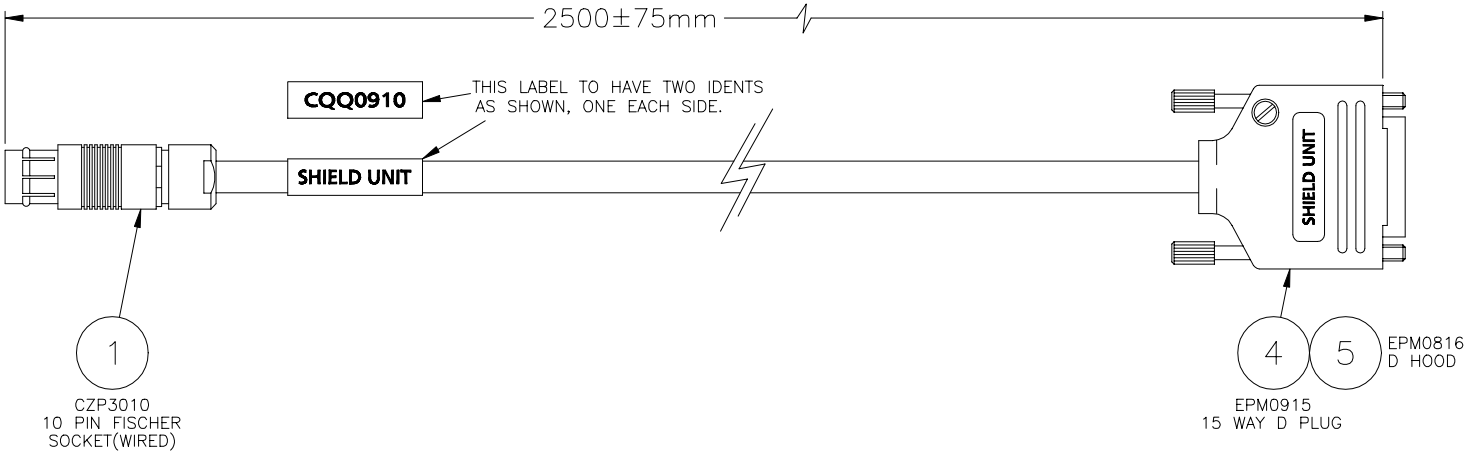


Figure 2 Pin numbers on a 10 way hermetically sealed Fischer connector viewed onto pins from the outside of the cryostat. Fischer part number 1031 Z010 (DBEE). (Mating connector Fischer part number SE1031 Z010)

Tip The connector on the cryostat is a plug and the pins are accessible.



FISCHER	*COLOUR*	*15 WAY"D"*
1	RED	5
2	BLUE	13
3	GREEN	–
4	YELLOW	14
5	WHITE	3
6	BLACK	11
7	BROWN	2
8	VIOLET	10
9	ORANGE	–
10	PINK	–
BODY	SCREEN	HOOD

NOTES:

1. FOR WIRING DETAILS SEE TABLE.
2. ENSURE ALL SOLDER JOINTS ARE SOUND.
3. ON COMPLETION OF ASSEMBLY CHECK THAT ALL CONNECTIONS AND COLOURS ARE CORRECT TO THE DRAWING.
4. LABEL AS SHOWN USING CURRENT LABELLING METHODS.

REV	DATE	DESCRIPTION	DRAWN	CHECKED	SIGNATURE	APPROVED
01	27:8:98	FIRST ISSUE	CHRIS HUDSON	CHRIS HUDSON		

DRAWING NUMBER CQQ0910 SHEET 1 OF 1

OXFORD INSTRUMENTS
RESEARCH INSTRUMENTS
TUBNEY WOODS, ABINGDON,
OXON, OX13 5QX, ENGLAND

TOLERANCES UNLESS STATED

METRIC	X	+/– 0.5mm
	X.X	+/– 0.3mm
	X.XX	+/– 0.1mm
	ANGLE	+/– 15min
IMPERIAL	X.X	+/– 0.015"
	X.XX	+/– 0.010"
	X.XXX	+/– 0.005"
	ANGLE	+/– 15min

SURFACE FINISH N6 UNLESS STATED

SCALE 1:1 UNLESS STATED

DIMS mm UNLESS STATED

TITLE

CRYOJET *98*

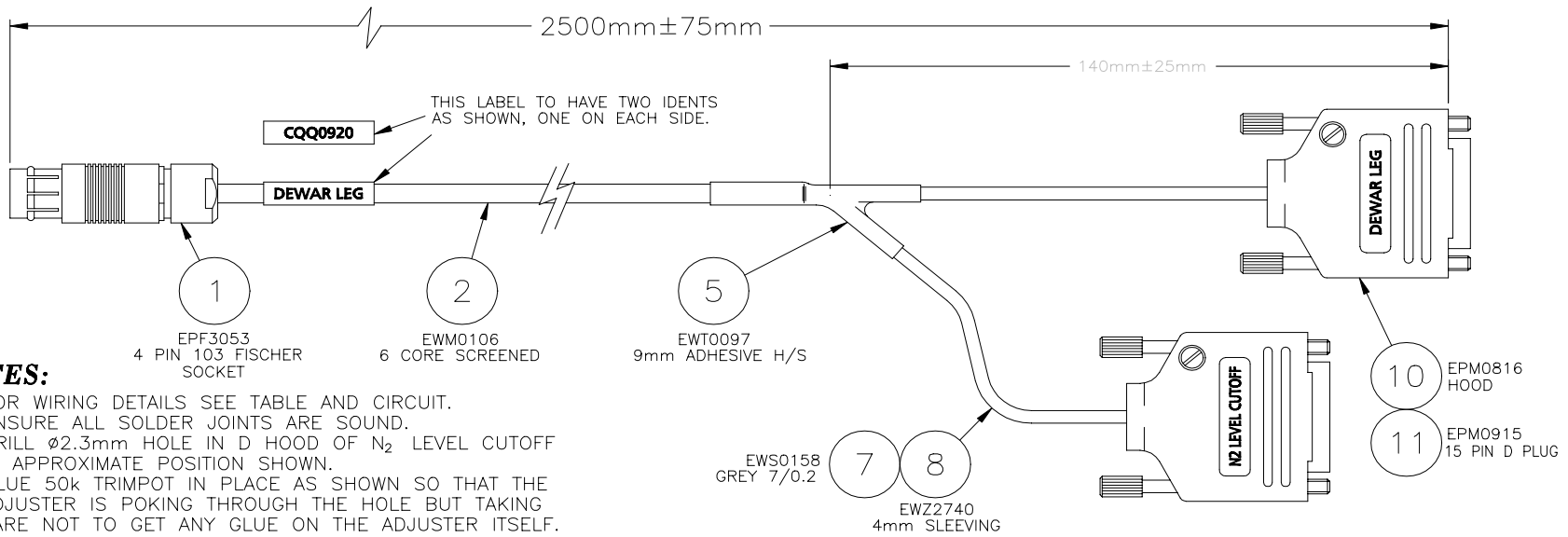
SHIELD UNIT CABLE ASSEMBLY

DO NOT SCALE IF IN DOUBT ASK

REMOVE ALL BURRS AND SHARP EDGES

OXFORD

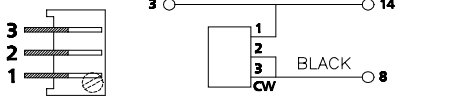
DRAWING NUMBER CQQ0910 SHEET 1 OF 1



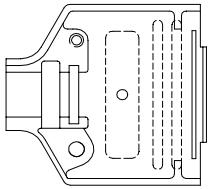
NOTES:

1. FOR WIRING DETAILS SEE TABLE AND CIRCUIT.
2. ENSURE ALL SOLDER JOINTS ARE SOUND.
3. DRILL ø2.3mm HOLE IN D HOOD OF N_2 LEVEL CUTOFF IN APPROXIMATE POSITION SHOWN.
4. GLUE 50k TRIMPOT IN PLACE AS SHOWN SO THAT THE ADJUSTER IS POKING THROUGH THE HOLE BUT TAKING CARE NOT TO GET ANY GLUE ON THE ADJUSTER ITSELF.
5. CUT BACK UNUSED CORES TO SHEATH.
6. EACH "BRANCH" TO HAVE GREY WIRE, ITEM 7, TO CONNECT SCREEN TO D HOODS.
7. EACH BRANCH TO BE SLEEVED USING ITEM 8.
8. LABEL AS SHOWN USING CURRENT LABELLING METHODS.
9. ON COMPLETION OF ASSEMBLY CHECK THAT ALL CONNECTIONS AND COLOURS ARE CORRECT TO THE DRAWING.

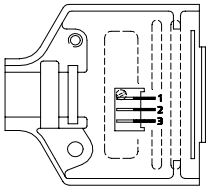
FISCHER	COLOUR	DEWAR LEG	N2 LEVEL CUTOFF
1	BLUE	1	–
2	GREEN	9	–
3	BLACK	–	14
4	RED	–	15
BODY	SCREEN	HOOD	HOOD



TRIMPOT VIEWED FROM BELOW



VIEW SHOWING HOLE FOR TRIMPOT



VIEW SHOWING POSITION OF TRIMPOT

REV	DATE	DESCRIPTION	DRAWN	CHECKED	SIGNATURE	APPROVED
01	28:8:98	FIRST ISSUE	CHRIS HUDSON	CHRIS HUDSON		

DRAWING NUMBER CQQ0920 SHEET 1 OF 1

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TOLERANCES UNLESS STATED

METRIC	X	+/- 0.5mm
	X.X	+/- 0.3mm
	X.XX	+/- 0.1mm
	ANGLE	+/- 15min
IMPERIAL	X.X	+/- 0.015"
	X.XX	+/- 0.010"
	X.XXX	+/- 0.005"
	ANGLE	+/- 15min

SURFACE FINISH N6 UNLESS STATED

SCALE 1:1 UNLESS STATED

DIMS mm UNLESS STATED

TITLE

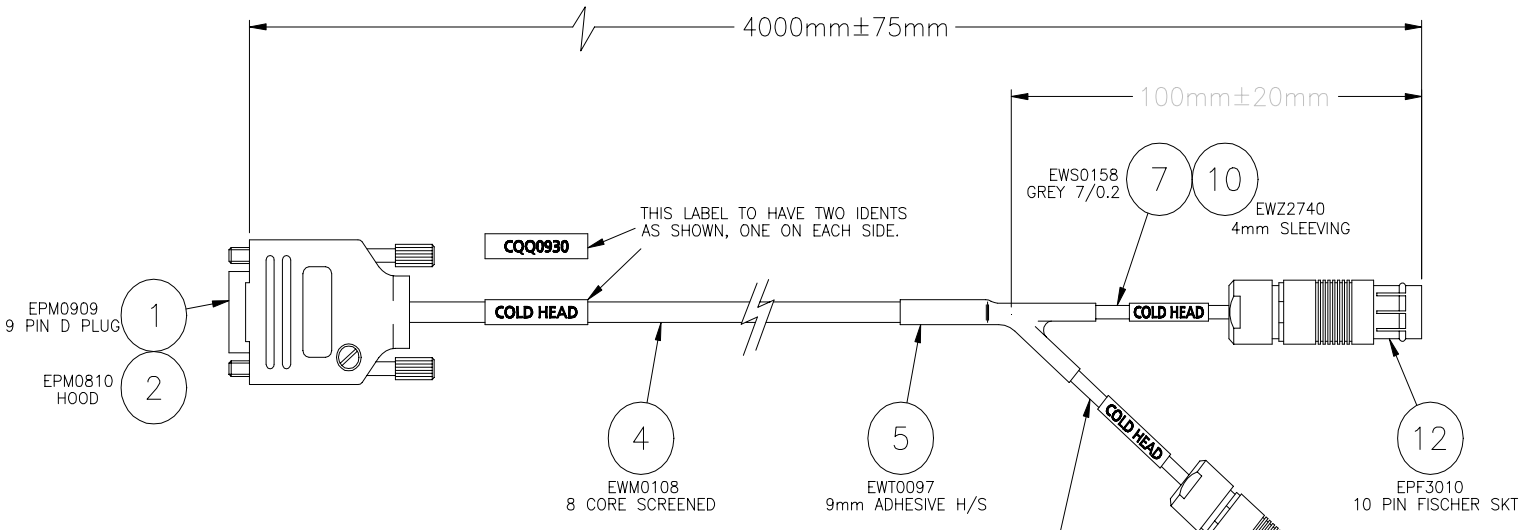
CRYOJET *98*

DEWAR LEG CABLE ASSEMBLY

DO NOT SCALE IF IN DOUBT ASK | REMOVE ALL BURRS AND SHARP EDGES

OXFORD

DRAWING NUMBER CQQ0920 SHEET 1 OF 1



"D"TYPE	COLOUR	10 PIN	4 PIN
1	RED	–	1
2	BLUE	–	2
3	GREEN	–	–
4	YELLOW	–	3
5	WHITE	–	4
6	BLACK	1	–
7	BROWN	2	–
8	VIOLET	–	–
9	–	–	–
HOOD	SCREEN	BODY	BODY

NOTES:

1. FOR WIRING DETAILS SEE TABLE.
2. ENSURE ALL SOLDER JOINTS ARE SOUND.
3. EACH "BRANCH" TO HAVE GREY WIRE, ITEM 7, TO CONNECT SCREEN TO FISCHER BODIES.
4. EACH BRANCH TO BE SLEEVED.
5. LABEL AS SHOWN USING CURRENT LABELLING METHODS.
6. ON COMPLETION OF ASSEMBLY CHECK THAT ALL CONNECTIONS AND COLOURS ARE CORRECT TO THE DRAWING.

REV	DATE	DESCRIPTION	DRAWN	CHECKED	SIGNATURE	APPROVED
01	28:8:98	FIRST ISSUE	CHRIS HUDSON	CHRIS HUDSON		

DRAWING NUMBER CQQ0930 SHEET 1 OF 1

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RESEARCH INSTRUMENTS
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TOLERANCES UNLESS STATED

	METRIC	IMPERIAL
X	+/- 0.5mm	
X.X	+/- 0.3mm	
X.XX	+/- 0.1mm	
X.XXX		
ANGLE	+/- 15min	
X.X		+/- 0.015"
X.XX		+/- 0.010"
X.XXX		+/- 0.005"
ANGLE		+/- 15min

SURFACE FINISH N6 UNLESS STATED

SCALE 1:1 UNLESS STATED

DIMS mm UNLESS STATED

TITLE

CRYOJET *98*

COLD HEAD CABLE ASSEMBLY

DO NOT SCALE IF IN DOUBT ASK | REMOVE ALL BURRS AND SHARP EDGES

OXFORD

DRAWING NUMBER CQQ0930 SHEET 1 OF 1

4 Instructions for Replacement of Electrical Components

No thermal dumping or anchoring is required for any of the wires in this product.

Removal from the dewar:

Remove all the electrical connectors. Undo the three M6 screws holding the dewar top fitting to the dewar. Undo the 4 M4 screws holding the coldhead to the stand. Remove the entire assembly from the dewar and from the stand. Before you lift the dewar legs away from the mouth of the dewar, wait until all the liquid nitrogen has drained out of them. Warm the assembly up to room temperature. If the dewar is empty and at room temperature, it is also possible to remove the sample flow leg and the shield leg separately from the dewar top fitting, without removing the top fitting from the dewar. To do this, first loosen the three small screws in the dewar top fitting, which clamp the assembly together.

4.1 Coldhead Heater

It is very difficult to remove the coldhead heater: only do so if absolutely necessary.

1. If the heat exchanger is cold, first set the controller to 300 K, and the sample flow to 2.1 l/min. Turn on the heat exchanger, and wait until the temperature displayed reaches 300 K.

2. Remove from the dewar (see above) and when warm, open the vacuum valve on the sample flow leg.

3. Serial numbers 51 - 55: remove the screws holding the shield tube to the coldhead flange, and bend the shield tube out slightly to allow the coldhead flange to be removed.

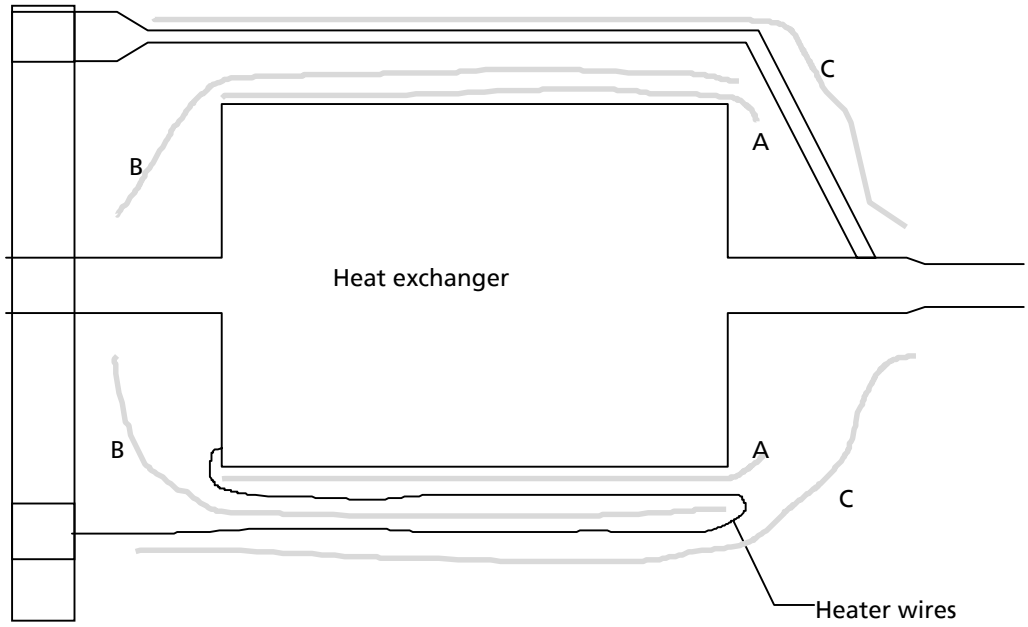
4. Serial numbers after 55: This is not required, as the shield tube is attached to the main body of the coldhead

5. Remove the screws holding the coldhead flange. Pull the coldhead body away from the flange. Do not twist. There are two sliding o-rings holding the coldhead body onto the nozzle, so a substantial force is needed.

6. Carefully remove the aluminised mylar wrapped around the heat exchanger, wearing gloves. Keep the mylar so you can put it back afterwards (see sketch and notes below)

7. There is one ‘spare’ heater hole in the heat exchanger. If this has not been used you can pot the new heater into this hole using Autostick. Leave it to set overnight. Solder the wires back. Wrap with aluminised mylar, as shown below.

8. If you have to remove the old heater soak the heat exchanger in hot water for at least 30 minutes. Desolder the heater connections and pull the heater out of its hole. Pot a new heater in using Autostick. Leave it to set overnight. Solder the wires back. Wrap with aluminised mylar, as shown overleaf.



A : 80 cm x 10 cm aluminised mylar, 8 turns, under the heater wire and under the 1/8" tube.

B : 28 cm x 13 cm, 2 turns, inside the heater wire loop, under the 1/8" tube.

C : 355 cm x 13 cm, 30 turns, outside the heater wires and outside the 1/8" tube.

Notes: Technique used:
The ends should be nipped in using tape or fishing line, but ensuring that the outer layers do not touch the heat exchanger or the inlet or outlet tubes.

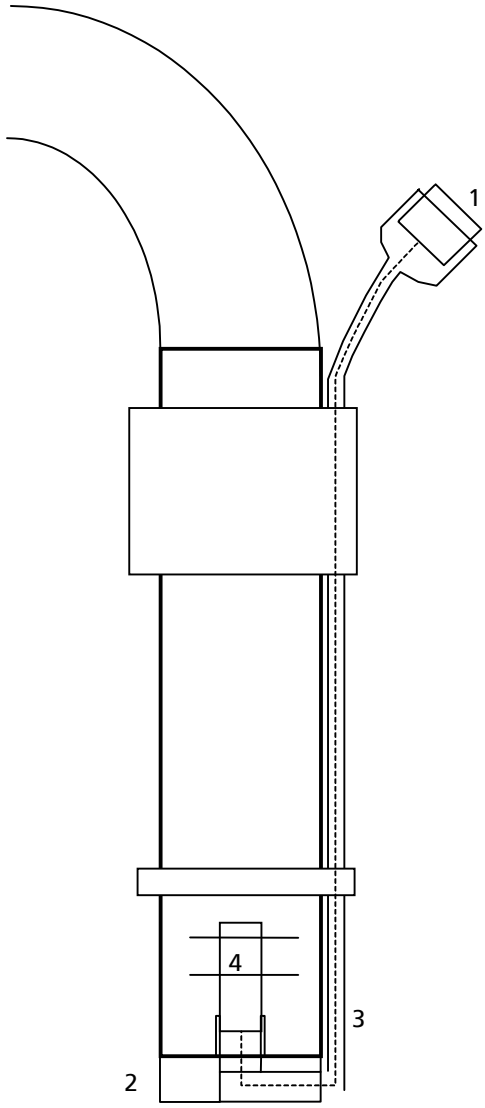
Tape used:
Aluminised mylar self-adhesive tape. Kapton tape can also be used if mylar tape is not available. Use as little as possible.

The aluminised mylar should be applied as loosely as possible. The outer layer will inevitably touch the OVC - this is not a problem.

Replace the coldhead body, and repump the vacuum, following the procedure in the manual to degas the sorb.

4.2 Sample Flow Unit: Dewar leg heater

Remove from the dewar as above.



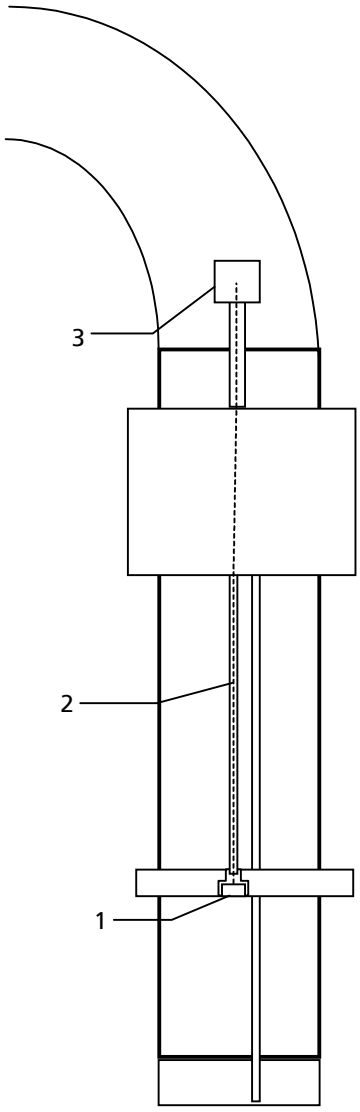
You can remove this heater without breaking the vacuum. Remove the Fischer connector (1) and desolder the two heater wires (pins 1 and 2, 0.4 mm Cu, coated with PTFE). Remove the 3 screws holding the heater flange (2) to the dewar leg, and remove the heater flange carefully pulling the wires out of their protective tube (3). Soak the heater assembly in hot water for at least 30 minutes, then remove the heater (4) with its wires from the flange. Disconnect the wires from the heater by squashing the crimps in the other direction to release the wires. Reconnect the wires to the new heater (with baffles attached) using new crimps. Feed the wires through the flange and use Autostick to glue the new heater in place

Use the high temperature sleeving to cover the crimps. Refit the heater flange into the bottom of the dewar leg and feed the wires carefully up their protective tube until they appear in the connector housing. Resolder the wires to the connector and refit the connector.

Put the system back in the dewar. Plug in the cable to the sample flow dewar leg. Measure the resistance of the new heater when in liquid nitrogen by measuring the resistance between pins 1 and 9 of the 15-way D-plug labelled "Cryojet dewar leg" before you plug it into the controller. Now switch on the controller and configure it for the new heater using test t 05 ("Configure"), subtest C 01. See the Technical Handbook for details. Make sure you store the configuration by holding CAL/STORE pressed while pressing SET.

4.3 Low level sensor (sample flow unit)

Pull hard on the low level sensor (1) to remove it from its hole. Pull out the wires just far enough to allow replacement of the sensor. Connect a new sensor, using heat shrink to cover the joints, and push it back into the hole.

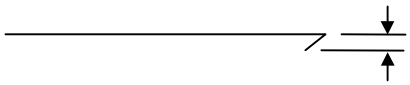


If you need to replace the wires (2), use 0.25 mm PTFE coated wire. Push it up from the sensor mounting hole, until it appears at the connector housing (3). Connect to pins 3 and 4 of the Fischer connector.

When you have reassembled the system and put it back into the dewar, adjust the potentiometer as follows. Remove the cover from the D-plug labelled "low nitrogen level cut-off". Plug it into the controller. Measure the voltage between pins 14 and 8 of the plug while it is plugged in. Adjust the potentiometer which is glued into the plug until the voltage is 2.30V +/- 0.02V. Confirm that this reading is steady. If it is slowly drifting, the sensor has not yet fully cooled to 77K and should be allowed longer to do so, before resetting the potentiometer.

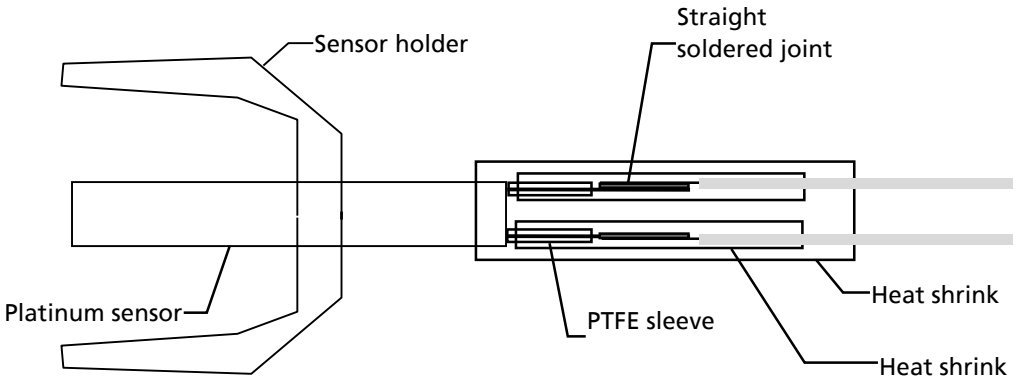
4.4 Nozzle Sensor (coldhead)

Make a hook using a paperclip:



3 mm approx

Carefully insert the hook about 5 cm into the nozzle, and pull out the sensor holder. Desolder the sensor. Soak the sensor and its holder in hot water for at least 30 minutes. Pull out the sensor. Stick a new sensor into the mount using Autostick. Heat the Autostick gently with a hot air gun for at least 5 minutes. Reconnect the wires as follows:



If you need to replace the wiring, use the 7-strand PTFE sleeved stainless steel wire, pushing it in from the connector end.

Push the sensor holder back into the nozzle, until the front of the sensor is 5 cm from the nozzle. The tapered end of the holder is inserted first. While you are pushing the sensor into the nozzle, pull gently on the wires at the connector end to prevent the sensor holder becoming tangled in the wires. Removing the connector from the coldhead does not break the vacuum.

4.5 Shield Unit Platinum Sensor and Heater

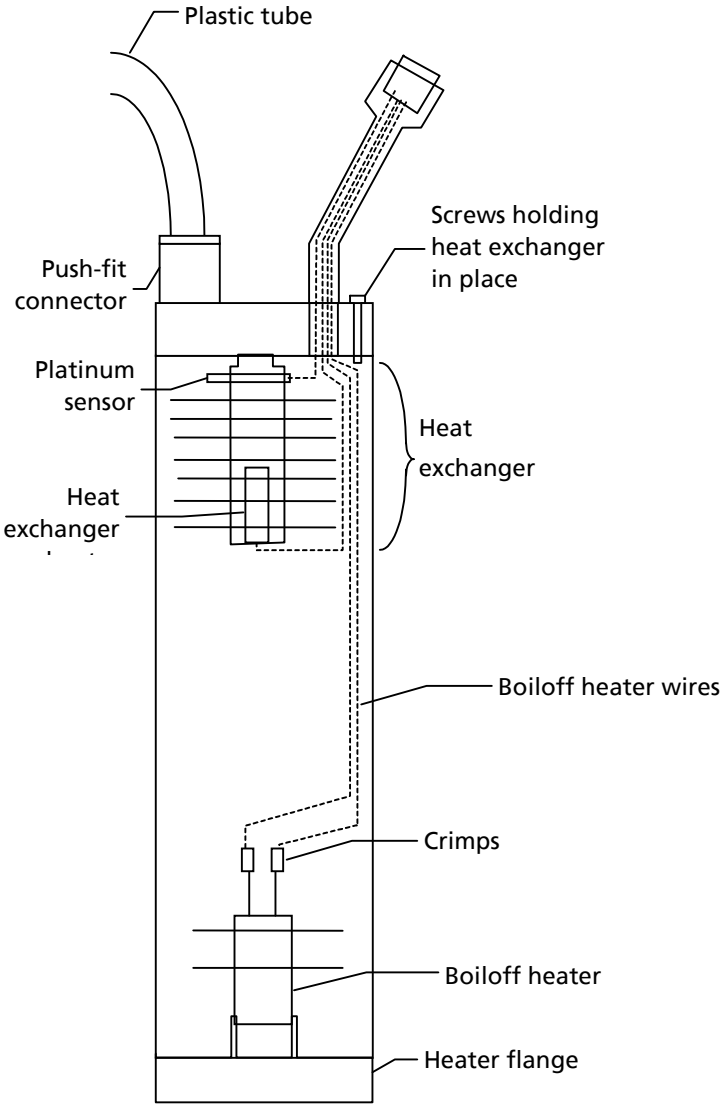


Figure 3. Shield unit

It is not absolutely necessary to remove the shield unit from the dewar, but it is advisable, to prevent moisture condensing inside the shield unit. Unplug the electrical connector and remove the plastic tube from the push-fit connector by pushing down on the spring-loaded ring while pulling on the tube. (Serial numbers 51 - 55: pull the plastic tube off the metal spigot.) Remove the 4 screws holding the heat exchanger in place. This will not break the vacuum. Carefully lift out the heat exchanger by the minimum amount, taking care not to stretch the wires running down to the boiloff heater at the bottom. Desolder the wires from the heater and sensor. Unscrew the heat exchange rod from the flange. Soak the component you want to remove in hot water for at least 30 minutes. Use Autostick to glue in the replacement heater or sensor. Heat it gently with a hot air gun for 5 minutes. Screw the heat exchange rod back into the flange. Reconnect the heater and sensor to the wires.

Note that the sensor is potted into the hole provided so that at least half of it sticks into the gas flow passing through the exit tube, and connected as follows:

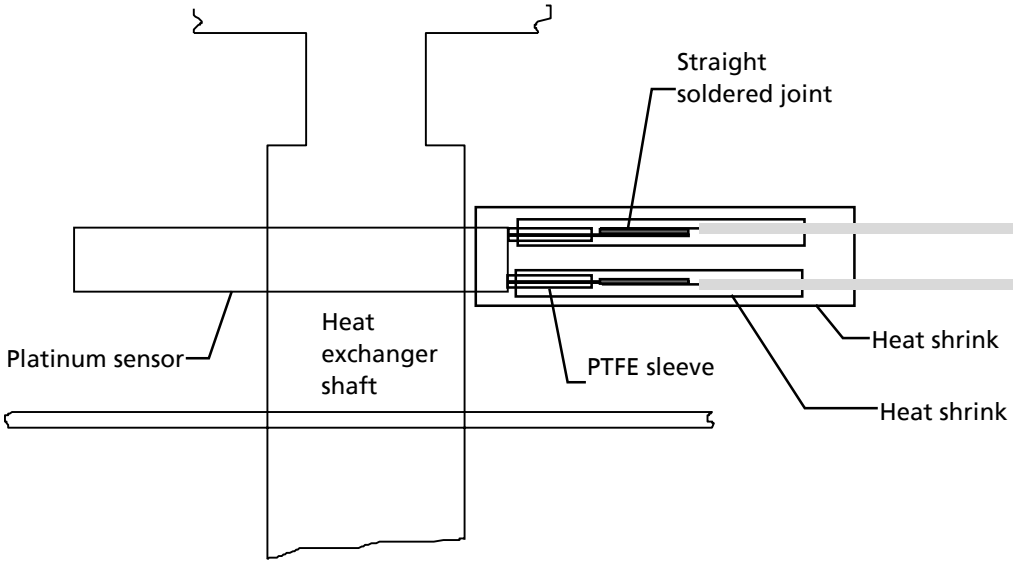


Figure 4

If you need to replace the wires to the heater pass the wires through the notches in the mesh discs.

When you put the heat exchanger back on the shield unit, align it so that the connector stalk is lined up with the vacuum valve knob.

4.6 Shield Unit: Boiloff heater (bottom of leg)

Remove from the dewar as above. See Figure 3.

Remove the 3 screws holding the heater flange to the dewar leg, and remove the heater flange. Disconnect the wires from the heater by squashing the crimps in the other direction to release the wires.. Soak the heater flange in hot water for at least 30 minutes, then remove the heater with its copper baffles. Use Autostick to glue in the new heater assembly. Heat gently with a hot air gun for 5 minutes. Reconnect the wires to the heater, using crimps rather than solder: slide the ends of the wires into a copper crimp and squash it with a pair of pliers. Use the high temperature sleeving to cover the crimps.

If you need to replace the wires, use 0.4 mm PTFE coated wire.

Put the system back in the dewar. Plug in the cable to the shield unit. Measure the resistance of the new heater when in liquid nitrogen by measuring the resistance between pins 2 and 10 of the 15-way D-plug before you plug it into the controller. Now switch on the controller and configure it for the new heater using test t 05 (“Configure”), subtest C 02. See the Technical Handbook for details. Make sure you store the configuration by holding CAL/STORE pressed while pressing SET.

5 Installing Swap-out Cryojet sample flow unit or shield flow unit

These instructions describe how to correctly install and set-up the Cryojet after one or both of the sample flow unit and shield flow units have been replaced.

Note: This instruction assumes the Cryojet sample flow unit or shield flow unit is not in the nitrogen dewar and that the Cryojet controller is switched off.

5.1 Changing over the Cryojet sample flow unit or shield flow unit

5.1.1 Removal and replacement

1. Remove cable(s) and polythene tube from old sample flow unit / shield flow unit.

2. Replace sample flow unit / shield flow unit with new sample flow unit / shield flow unit.

3. Re-connect cable(s) and polythene tube to new sample flow unit / shield flow unit.

5.1.2 Inserting Cryojet into dewar

1. Ensure the dewar top fitting is securely screwed down on to dewar using 3 off M6 bolts.

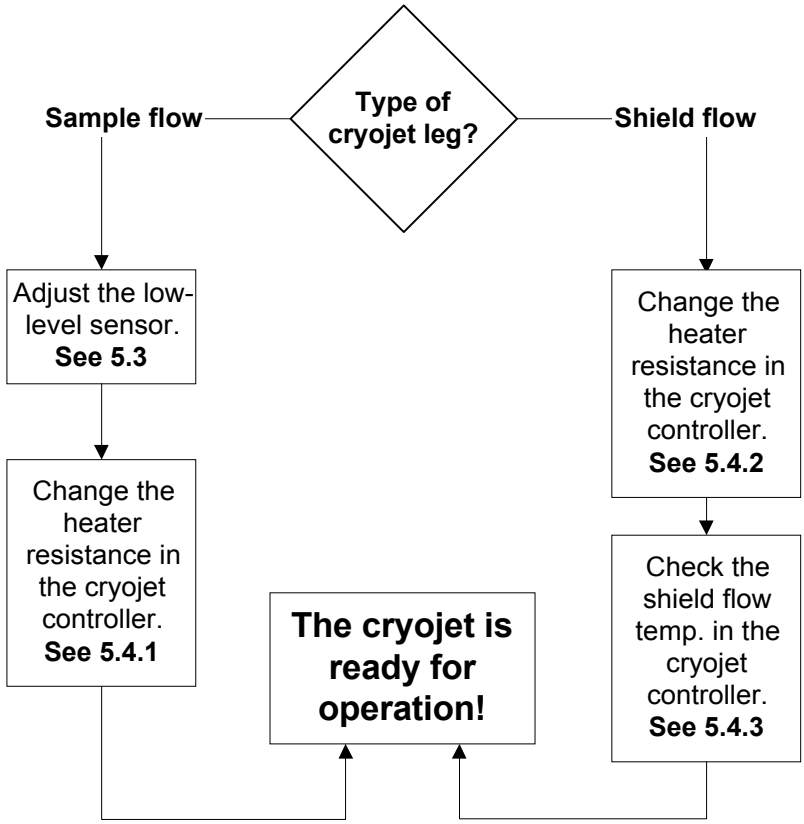
2. Loosen the 3 off M4 bolts that compress the O-rings in the dewar top fitting.

3. Is the dewar empty? If not insert both cryojet legs into slowly dewar so as to avoid injury.

4. Re-tighten 3 off M4 bolts so as to seal the O-rings against the cryojet legs.

5. If the dewar is empty it should now be refilled to at least half full (40 cm).

5.2 Configuring new sample flow unit or shield flow unit



5.3 Adjusting the liquid nitrogen level cut-off sensor

The liquid nitrogen level sensor adjustment cable should be connected in line with the liquid nitrogen level Cut-off cable and the Cryojet Controller as shown below.

Figure 5 Rear view of the Cryojet Controller

1. Switch ON the Cryojet Controller.

2. Connect the liquid nitrogen level sensor adjustment cable to a Digital Volt Meter, so the sensor voltage can be measured.

3. In the 15 way connector labelled liquid nitrogen CUTOFF is a variable resistor, shown below

Figure 6 15 Way connector showing variable resistor

4. The variable resistor should be adjusted.

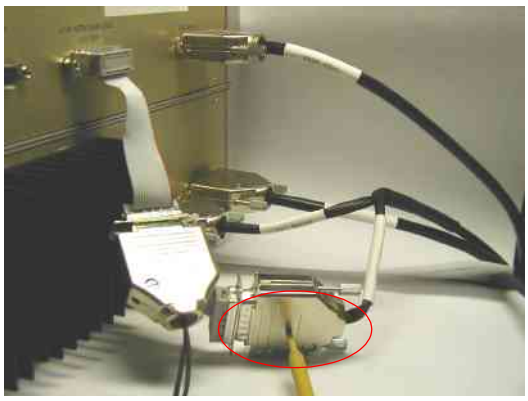


Figure 7 Adjusting the variable resistor

5. Until the voltage shown on the D.V.M. is 2.3V(dc).

Figure 8 Digital Volt Meter

5.4 Configuring the Cryojet Controller

5.4.1 Adjusting the sample flow unit heater value

1. Enter the Test mode menu (press and hold **Raise** + **Lowe**r then press **Set**) the display should read **T00.**
2. Press **Raise** or **Lower** until the display to reads **T05.**
3. Press **Set**, the display should now read **C00**.
4. Press **Raise**, the display should now read **C01**.
5. Press and release **Set**, the display is now showing the current heater resistance.
6. Press and hold **Set**, now press **Raise** or **Lower** to change the display to read the specified resistance, as stated in the supplied in the Test file.
7. Release **Set**, the display should read **C01**.
8. Press **Lower** until the display reads **C00.**
9. Press **Set** and the display should now be showing the temperature of the sensor.
10. Press and hold **Cal/Store**, now press **Set** to store the new setting.
11. Refer back to flow chart.

5.4.2 Adjusting the shield flow unit heater value

1. Enter the Test mode menu (press and hold **Raise** + **Lowe**r then press **Set**) the display should read **T00.**
2. Press **Raise** or **Lower** until the display to reads **T05.**
3. Press **Set**, the display should now read **C00**.
4. Press **Raise**, until the display reads **C02**.
5. Press and release **Set**, the display is now showing the current heater resistance.
6. Press and hold **Set** now press **Raise** or **Lower** to change the display to read the specified resistance, as stated in the supplied in the Test file.
7. Release **Set**, the display should read **C02**.
8. Press **Lower** until the display reads **C00.**
9. Press **Set** and the display should now be showing the temperature of the sensor.
10. Press and hold **Cal/Store**, now press **Set** to store the new setting.
11. Refer back to flow chart.

5.4.3 Adjusting the shield flow unit temperature value

1. Enter the Test mode menu (press and hold **Raise** + **Lowe**r then press **Set**) the display should read **T00.**
2. Press **Raise** or **Lower** until the display to reads **T05.**
3. Press **Set**, the display should now read **C00**.
4. Press **Raise**, until the display reads **C03**.
5. Press and hold **Set,** then press **Raise** or **Lower** (if necessary) to change the display to read the temperature stated in the test file supplied. (The default value is 30^{0}C).

6. Release **Set**, the display should read **C03**.
7. Press **Lower** until the display reads **C00.**
8. Press **Set** and the display should now be showing the temperature of the sensor.
9. Press and hold **Cal/Store**, now press **Set** to store the new setting.
10. Refer back to flow chart.

6 Screws and O-rings used

Description	Number used
XYZ Stage	
Screw stainless cap M10 x 60	1
Screw stainless cap M3 x 10 set	12
Screw stainless cap M4 x 10 set	4
Screw stainless cap M4 x 12 set	2
Dewar Top Fitting	
Screw st. tamperproof M4 x 10	1
O Ring R03062 BS114	1
Screw stainsless cap M6 x 16 set	3
Screw stainless cpa M4 x 35 set	3
O Ring R2012 BS006	3
O Ring R03200 BS136	2
O Ring R04425 BS244	1
O Ring 1.5 x 0.103 BS128 VIT	2
Sample Flow Leg Heater assembly	
Screw stainless cap M2.5 x 10 set	3
Vacuum valves	
O Ring 0.437 x 0.07 60 shore	2
Sample Flow leg	
Screw stainless cap M3 x 6 set	6
Screw stainless cap M3 x 16 set	2
O Ring R02050 BS014	2
O Ring R03225 BS140	1
Shield Leg	
Screw stainless cap M2.5 x 16 set	4
Screw stainless cap M2.5 x 10 set	3
O Ring R02106 BS023	1